DOCUMENT RESUME

ED 091 856 EA 006 215

AUTHOR	Baldridge, J. Victor
TITLE	The Impact of Individuals, Organizational Structure, and Environment on Organizational Innovation. Research and Development Memorandum No. 124.
INSTITUTION	Stanford Univ., Calif. Stanford Center for Research and Development in Teaching.
SPONS AGENCY	National Inst. of Education (DHEW), Washington, D.C.; Office of Education (DHEW), Washington, D.C.
REPORT NO	RD-Memo-124
PUB DATE	May 74
CONTRACT	NE-C-00-3-0062; OEC-6-10-078
NOTE	46p.
EDRS PRICE	MF-$0.75 HC-$1.85 PLUS POSTAGE
DESCRIPTORS	Educational Change; *Educational Innovation; *Educational Research; *Environmental Influences; Organization; *Organizational Change; Organizational Development; Organizational Effectiveness; Organizational Theories; *School Organization

ABSTRACT

This paper argues that research on innovation and organizational change should shift its focus from the impact of individuals to that of organizational structure and environmental factors. The results of two research projects carried out in 1968-69 and 1969-70 on organizational change in school districts are presented to support the premise that complex organizations with heterogeneous environments are more likely to initiate and sustain innovative behavior than are simple organizations with relatively homogeneous environments. Some organizational policy implications suggested in light of the findings are that deliberate attempts should be made to build differentiation and complexity into an organization's structure, interorganizational committees on innovation should be set up, and channels of communication should be opened to an organization's environment. (Author)

ED 091856

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Research and Development Memorandum No. 124

THE IMPACT OF INDIVIDUALS, ORGANIZATIONAL STRUCTURE, AND ENVIRONMENT ON ORGANIZATIONAL INNOVATION

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May 1974

Published by the Stanford Center for Research and Development in Teaching, supported in part as a research and development center by funds from the National Institute of Education (Contract No. NE-C-00-3-0062), U. S. Department of Health, Education, and Welfare, and, for part of the work described herein, from the Office of Education (Contract No. OEC-6-10-078). The opinions expressed in this publication do not necessarily reflect the position, policy, or endorsement of the National Institute of Education or the Office of Education.

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Introductory Statement

The Center's mission is to improve teaching in American schools. Its work is carried out through five programs:

- Teaching Effectiveness
- The Environment for Teaching
- Teaching Students from Low-Income Areas
- Teaching and Linguistic Pluralism
- Exploratory and Related Studies

A part of the Environment for Teaching Program is concerned with innovation in organizations, particularly academic organizations. This paper reports on studies of organizational change in school districts in two areas of the country.

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Abstract

This paper argues that research on innovation and organizational change should shift its focus from the impact of individuals to that of organizational structure and environmental factors. The results of two research projects carried out in 1968-69 and 1969-70 on organizational change in school districts are presented to support the premise that complex organizations with heterogeneous environments are more likely than simple organizations with relatively homogeneous environments to initiate and sustain innovative behavior. Some organizational policy implications suggested in light of the findings are: (1) deliberate attempts should be made to build differentiation and complexity into an organization's structure; (2) interorganizational committees on innovation should be set up; and (3) channels of communication should be opened to an organization's environment.

THE IMPACT OF INDIVIDUALS, ORGANIZATIONAL STRUCTURE, AND ENVIRONMENT ON ORGANIZATIONAL INNOVATION

J. Victor Baldridge

For many years anthropologists, sociologists, organizational theorists, and social psychologists have been interested in the diffusion processes of technological and social inventions. In 1962 Rogers reviewed over 500 articles in the area of innovation diffusion, and since then the literature on the topic has grown rapidly--as shown in Rogers's revised edition (Rogers and Shoemaker, 1971), which reviewed 1,500 articles. The innovations studied cover a broad spectrum of social life: smallpox inoculations (Miller, 1957); educational innovations (Mort and Cornell, 1938; Ross, 1958; Miles, 1964; Carlson, 1967; Knight, 1967; Guba, 1968; Keeley, 1968; Corwin, 1972); agricultural inventions (Lionberger, 1960; Rogers, 1962); child-rearing practices among American mothers (Brim, 1954; Maccoby et al., 1959); medical inventions (Caplow, 1952; Coleman, 1966); the introduction of modern machinery into underdeveloped nations (Goldsen and Ralis, 1957). Without question, then, the diffusion of innovation has continued to interest social scientists--the factors promoting that diffusion, the barriers holding it back, the patterns of communication surrounding it, and the evaluation of whether social inventions are accomplishing their purposes.

One growing branch of the research has dealt with the diffusion of new organizational practices. The research question usually asks:

This paper was prepared with the assistance of Jeanette Wheeler, project writer.

The author wishes to acknowledge his debt to several people who participated in the studies drawn upon in this paper. Kenneth Knight supervised the Bay Area project, and Thomas Gans, William Gorth, Gerald Hamrin, Olan Knight, William Penny, and William Schmick participated as co-workers. Robert Burnham carried out the Illinois phase of the research. See the dissertations cited in the References and Baldridge and Burnham, 1973.

What characteristics distinguish highly innovative organizations from less innovative ones? The answer most often takes one of three forms:

1. Certain individuals are prone to innovative behavior (e.g., younger, more cosmopolitan, better-educated males). Therefore, organizations with a high percentage of such individuals are likely to be more innovative. (See Rogers, 1962, and Rogers and Shoemaker, 1971, for extensive reviews of literature in this tradition.)

2. A high degree of organizational complexity and large size promote innovative behavior because they permit specialized expertise in subunits and because they incur critical masses of problems that demand solution. (See Wilson, 1963; Hage and Aiken, 1967; Sapolsky, 1967.)

3. Heterogeneous or changing environments surrounding organizations are likely to cause problems that call for innovative organizational solutions. (See Evan, 1965; Terreberry, 1965; Baldridge, 1971.)

Beginning in 1968 the Stanford Center for Research and Development in Teaching, part of the federal education research network, sponsored two studies of organizational change and innovation. The goal of these studies was to make a cohesive, integrated, and long-term investigation of change in educational organizations. For this paper the data from both projects have been reanalyzed to satisfy three purposes:

1. To test the three major hypotheses about organizational innovation in the same research effort.

2. To test the hypotheses in large samples, since a weakness of organizational innovation studies has been small sample sizes.

3. To spell out some of the policy implications of the findings of the two studies for the management of educational organizations.

Research Methodology

In 1968-69 the first of the two studies examined twenty randomly selected schools in seven districts in the San Francisco Bay Area. Extensive information about the districts and schools was collected

from district records and from interviews with district superintendents and principals of individual schools. In addition, three groups of individual teachers were interviewed: (1) "opinion leaders," nominated by principals and department chairmen as leaders in change efforts (N=53, all interviewed); (2) "change participants" (N=428, 309 interviewed); and (3) a 50 percent random sample of all faculty members (N=861, 775 interviewed).

The second study focused on 264 of the 1,227 school districts in the state of Illinois in 1969-70. Only large school districts were sampled, since small districts of one or two schools would not normally be considered "complex" organizations. The sample of 264 schools was randomly selected from elementary districts of over 1,000 students and secondary districts of over 500 students. Data were collected in three ways: (1) A questionnaire was sent to each district superintendent, resulting in a usable sample of 184 schools (70 percent). (2) The division of finance and statistics of the Illinois Office of the Superintendent of Public Instruction provided punched card records of enrollments and other school district characteristics for each district involved. (3) Environmental and demographic data for each district were drawn from the County and City Data Book and the Census of Governments, 1962. Because the available demographic and population data were based on counties and some school districts were located in more than one county, information about the county in which the school district offices were located was used. Although districts and counties were not entirely coterminous, this procedure gave a reasonably accurate estimate of the population characteristics of the district. The Chicago School District was omitted from the analysis because it was assumed to be atypical.

The Dependent Variable: Innovations

Much of the innovation literature has concentrated on limited kinds of technological innovations. For example, in the widely used agricultural diffusion studies, the innovation studied had several

characteristics. First, it was highly technical and its effectiveness had been well proved before it was disseminated (e.g., new types of seeds). Second, there was a relatively short payoff time in which the person adopting the innovation could tell whether it was working and decide whether or not to continue using it (one season's crops could usually convince a farmer to use a new seed). Third, the innovation's technical efficiency could be readily evaluated and its results were easily interpreted (the farmer could determine the productivity of a new grain). Finally, the decision maker adopting the innovation was either an individual or a small group, not a complex organization (the individual farmer could choose a new seed without a complicated organizational decision).

It is important to realize that most major social and educational innovations are not so technically narrow or so easily put into effect. (See Table 1.) First, the technology of social action programs is complicated and depends heavily on professional judgment, creative insight, and practical experience. Second, the results from social or educational technology rarely have a short payoff time during which an innovation's effectiveness can be evaluated. Instead it may take months or years to determine whether the innovation has strengthened or improved an organization. Third, most organizational innovations are difficult to evaluate. The decision base of a farmer is simpler than that of a teacher, a school, or a social action agency. If the grain grows the farmer knows his innovation is working. But how does a school know whether its students have learned social studies better under a new system? How does a social action agency evaluate its success at rehabilitating criminals? Finally, the adopter of most social innovations is often a complex organization--a school district, university, city government, or county welfare agency. The complexity of the decision process and the multiple chains of command necessary to carry out a decision make the diffusion of social innovation entirely different from the simple one-man adoption of a new seed, drug, or piece of equipment.

TABLE 1

Comparison of Different Types of Innovations

Types of Innovations Usually Examined by the Literature on Innovation and Diffusion	Most Educational Innovations and Social Action Programs
1. Clear Technology - the processes and their outcomes are readily understood and applied.	1. Unclear Technology - processes and their outcomes are not readily understood or easily applied.
2. Short-range Payoff - results can be seen in a relatively short time.	2. Long-range Payoff - results will be seen after a long time period has elapsed.
3. Clear Evaluations - it is possible to get clear reading on whether the innovation is effective.	3. Organizational Adoption - complex decision needed on whether to implement or reject an innovation.
4. Individual Adopter - individual decides to accept or reject the innovation.	4. Unclear Evaluations - not always possible to set definite guidelines or evaluate effectiveness of innovation.
Examples: - Drugs - New agricultural products or techniques - Machinery and tools	Examples: - Modular scheduling in schools - Team teaching - Manpower training programs - Community mental health programs

Different analytic tools must be developed to understand the complex process of organizational innovation. In order to examine the adoption of seeds by a farmer, for example, political coalitions and organizational decision making need not be considered, but it would be suicide not to take those dynamics into account in adopting a new social studies curriculum in a public school. In examining innovations such as welfare reform and school integration, it is critical to analyze the reward structure, the authority lines, and the decision-making processes of the large organizations involved. Although rare, research on this type of complex situation does exist in the studies of community adoptions of fluoridation during the 1950s (Crain, 1962), and of the adoption of innovations in complex school districts (Burnham, 1972; Corwin, 1972).

The two studies reported on in this paper were precise in examining organizational innovations and changes with (1) relatively unclear technologies, (2) long-range payoffs, (3) evaluations that might not be readily apparent, and (4) organizational rather than individual adopters. Most major social action and organizational changes fall into this category. In addition three other conditions were imposed:

1. Extensity: the innovation covered a relatively large number of people and/or processes within the organization and was not limited to a small subgroup.

2. Importance: knowledgeable observers believed the innovation had real potential for creating change in a major educational area.

3. Longevity potential: the innovations were well established and appeared able to continue for a significant time period.

In each study the determination of what innovations met these criteria was specific to the situation. In the Bay Area study, principals, superintendents, and department chairmen specified the innovations adopted in their schools that met the criteria. Of the innovations nominated, one "curricular" innovation (e.g., new reading program) and one "organizational" innovation (e.g., new team-teaching approach) were selected in each school. In the Illinois study intensive interviews were held with school superintendents to compile a list of 20

major innovations that met the criteria. The school districts were then asked to specify the ones they had adopted.

The information gathered in the studies was used to answer two questions: (1) Do people who participate in organizational changes have special characteristics? (2) Do organizations with high rates of innovation have unique features? A preview of the results can be given in three statements:

1. Individual characteristics, such as sex, age, and personal attitudes, do not seem to be important determinants of innovative behavior among people in complex organizations. However, administrative positions and roles do seem to have an impact on the involvement of individuals in the innovation process.

2. The structural characteristics of an organization, such as its size and complexity, strongly affect its innovative behavior.

3. Environmental input from the community and other organizations is a major determinant of an organization's innovative behavior.

Individual Characteristics and Organizational Position

Most research on innovation diffusion has concentrated narrowly on factors causing an individual user to adopt or reject an invention. Usually the dependent variable concerned the characteristics of individual adopters: Would mothers adopt birth-control pills? Would natives substitute a steel ax for their traditional stone one? Sometimes the rate of adoption was the dependent variable: How fast would individuals with X characteristic adopt the innovation as compared to individuals with Y characteristic? The independent factors seen as producing the behavior were typically individualistic: Were the adopters young or old, traditional or modern, rich or poor, opinion leaders or followers, of high social status or low? (See Rogers and Shoemaker, 1971, and Rogers's review, 1962.) Arguments about individual characteristics as determinants of innovative behavior have also been specifically offered for educational organizations (Carlson, 1967).

In spite of the individualistic tradition in the literature, it was assumed in the studies reported on here that individual characteristics would not be particularly significant in predicting leaders in organizational change. The Bay Area project compared three groups:

1. Opinion Leaders: the prime movers in pushing for new curricula and organizational changes.
2. Participants: those involved in a change as followers rather than leaders.
3. All Faculty: a random sample of the entire faculty of all the schools.

If individual characteristics were actually important for predicting change-oriented behavior, there should be sharp differences between these groups, with Opinion Leaders at one extreme and All Faculty at the other. The literature suggested that Opinion Leaders would likely be males, older on the average than their colleagues, less satisfied with their careers, of higher social origin and education, and significantly more cosmopolitan as determined by travel experience, scholarly journals read, and work experience outside their district. The results of the study, however, do not support these assertions. As Table 2 shows, no important differences were found between the random sample of the faculty and the participants in change. The Opinion Leaders were found to be a little older, to be more often males, and to have slightly more education, but the differences were small and not statistically significant. This important finding contradicts years of research on innovation diffusion. The conclusion that individual demographic characteristics and attitudes are poor predictors of innovative behavior in an organizational context is supported by Hage and Aiken, who report in their study of social welfare agencies:

> The results of our study clearly suggest that structural properties were much more highly associated with the rate of program change than attitudes toward change. This implies that the structure of an organization may be more crucial for the successful implementation of change than the particular blend of personality types in an organization.
> [Hage and Aiken, 1970, pp. 122-23.]

TABLE 2

Individual Characteristics of Three Faculty Groups

Faculty group	Sex: Proportion of males (%)	Median Age	Median career satisfaction score[a]	Median social origin score[b]	Median educational achievement score[c]	Median no. units past B.A. degree	Median education index	Median no. recent units of education	Median no. years inside district	Median no. year outside district	Median work experience index	Median no. other districts worked in	"Cosmopolitanism": Median no. conferences attended this year	"Cosmopolitanism": Median no. summer institutes attended	"Cosmopolitanism": Median no. journals read regularly	"Cosmopolitanism": Median cosmopolitan index
Opinion Leaders in change (N = 53)	74.1	39.0	1.4	39.7	3.9	94.0	8.5	6.7	7.7	1.3	6.5	2.2	3.9	1.2	3.4	11.4
Participants in change (N = 309)	66.6	37.4	1.5	42.1	3.7	91.7	8.1	5.7	7.5	1.8	6.2	1.9	3.1	1.1	3.3	9.8
All Faculty random sample (N = 775)	62.4	35.5	1.7	39.8	3.6	82.7	7.8	6.8	6.3	1.7	5.7	1.9	2.7	1.1	2.9	8.9

Source: Data assembled from charts in Penny (1970), pp. 112, 114.

[a] 5-point scale; higher score = less satisfaction.

[b] Lower score = higher social class; Hollingshead Two-factor Index of social position, range 11-77.

[c] 1 = no formal education, 3 = bachelor's degree, 5 = doctorate.

When individuals are the innovation adopters, as in the innovation processes studied by most previous researchers, individual characteristics are important. When organizations are the innovation adopters, organizational characteristics probably account for differences in innovative behavior.

Factors that bridge the distance between the individual level and the organizational level are organizational positions and authority roles, which the data do show to be important for understanding people's participation in change processes. The Bay Area study found a number of positional factors that influenced the process of change:

1. All participants in the change process--teachers, chairmen, and administrators--nominated department chairmen and administrators as the critical initiators of change out of proportion to their number. (See Table 3.)

2. Administrators and department chairmen were nominated as the dominant evaluators, the people who made judgments about the quality of work in the change process. (See Table 3.)

3. Administrators and department chairmen were most often nominated as the people who controlled organization sanctions, such as salaries, working conditions, and class assignments. (See Fig. 1.)

4. Department chairmen were seen as playing the particularly important role of communication link between carrying out changes and administrators supporting those changes with resources. (Not shown.)

From our data it appears that administrative leadership and authority are vital to successful innovation. Three explanations for this finding seem plausible. First, administrators and department chairmen are links in the communication process that ties together teachers and resources in the change process. Second, administrators are almost exclusively responsible for applying organizational sanctions and, as a consequence, their support is critical to the change process. Third, the interviews accompanying the questionnaires indicated that the administrators were extremely important as "boundary role" people; that is, they served as

TABLE 3

Key Leaders Nominated by Participants in Innovative Changes

If participants were	Then they nominated as initiators of change			
	Teacher	Chairman	Administrator	Total
Teachers	46%	26%	28%	100%
	(128)	(72)	(79)	(279)
Department chairmen	8%	31%	61%	100%
	(7)	(27)	(53)	(87)
Administrators	41%	11%	48%	100%
	(43)	(12)	(51)	(106)
TOTALS	38%	23%	39%	100%
	(178)	(111)	(183)	(472)
If participants were	**Then they nominated as evaluators of work in the change activity**			
Teachers	48%	20%	32%	100%
	(396)	(163)	(260)	(819)
Department chairmen	24%	26%	50%	100%
	(77)	(81)	(156)	(314)
Administrators	40%	26%	34%	100%
	(121)	(78)	(101)	(300)
TOTALS	42%	22%	36%	100%
	(594)	(322)	(517)	(1,433)

Source: Assembled from data in Gorth (1971), pp. 83, 104.

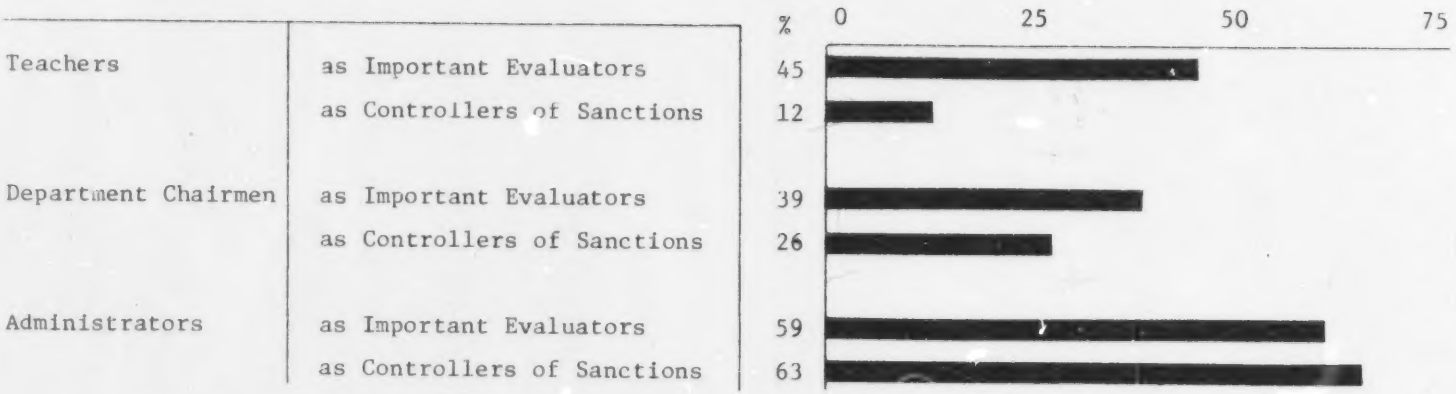

Fig. 1. Evaluators and controllers of sanctions nominated by participants in innovative changes. (Source: Assembled from data in Gorth [1971], pp. 121, 126.)

a link between demands and ideas from outside the schools and the innovations occurring inside them.

In sum, it appears that although individual characteristics are not particularly critical in predicting who will be change leaders, organizational position and role are highly influential. Only when individual characteristics are coupled with an administrative position that has authority and resources do they become vital to innovation.

Organizational Factors: Size and Complexity

It is rare to find organizational characteristics treated in the diffusion literature. Rogers's monumental review (1962) of the innovation literature summarized the research conclusion in 52 major propositions, and not one referred to a complex organization as the innovation adopter or to organizational factors as independent variables affecting the process. In fact, Rogers and Shoemaker, in their 1971 revision of the innovation overview, explicitly state that "by far the most popular diffusion research topic has been variables related to individual innovativeness" (p. 71). Although chapters were added to deal with organizational innovation, once again they focused on individual behavior, located this time within organizational settings.

The inattention to organizational factors persists despite the fact that most major social policy inventions being diffused today are used by complex organizations. Educational inventions, community action projects, new technologies in industry, and new health delivery systems are social inventions primarily adopted by complex organizations, not by individuals. Thus more attention to organizational factors in the innovation process is needed for two reasons: (1) organizations are now the major adopters of social inventions, and (2) organizational factors and organizational dynamics are the major independent variables that seem to influence the amount, the rate, and the permanence of innovations. Two characteristics affecting an organization's innovative capacity are its size and its administrative complexity. These factors are closely related: many studies have shown that increases in size are directly

related to increases in complexity as measured by the number of hierarchical levels, the number of administrative positions, and the ratio of administrators to other employees (Blau, 1970).

Argument

In most situations increased size and complexity are expected to lead to increased innovation. Increased structural complexity (partly caused by large size) leads to specialization; specialists see varying problems, handle specialized subtasks, and then initiate search procedures for more efficient techniques to reach their goals (see discussion by March and Simon, 1958). This diversity, however, tends to produce high levels of conflict, as separate but highly interdependent components interact. As the problems and solutions multiply, conflicts over resources and goals must be resolved by an integration mechanism, such as hierarchical decision making or joint policy making by coordinating committees. Both differentiation, in terms of structural units, and integration, in terms of coordinating mechanisms, help promote innovation--the former by creating specialists to seek new solutions, and the latter by providing a means for overcoming conflict (see Lawrence and Lorsch, 1967). Thus as the number of differentiated components increases, the quantity of alternatives and solutions also increases in response to perceived unique problems. The diversity of incentive systems and task structures resulting from differentiation is another major reason for increased innovation.

Size, too, greatly affects innovation. Not only does increased size promote complexity (Blau, 1970) but it creates problems of coordination, control, and management that in themselves demand innovative practices. Moreover, increased size expands certain problems to a sufficient extent that innovation must be generated to handle them. For example, a small school district is unlikely to have enough handicapped students to initiate special programs for them, but the reverse is true in a large district. Finally, increased size expands the possibilities for interacting with the environment of a school district, since additional clients multiply the number of interested outsiders making their special demands--as Table 4 from the Bay Area project clearly shows.

TABLE 4

School Size and Environmental Influence

Outside influencing factors	Influence rating		Number of encounters	
	Small schools	Large schools	Small schools	Large schools
State funds	35	52	13	21
Community individuals	46	60	34	48
State law	51	51	29	38
Federal law	37	43	12	21
Federal funds	24	58	10	20
Parent-school organization	40	49	39	51
Local businesses	23	32	17	20
Private foundations	16	13	9	7
Community groups	13	25	11	19
Federal advice	8	20	6	8
State advice	8	18	10	14

Source: Data assembled from Hamrin (1970), pp. 146-147.

Results

The empirical results of the two studies clearly support the theoretical argument, for in both of them increased size and complexity were positively related to innovation. The analysis of innovations in the Bay Area schools and districts showed a perfect rank order between increasing district size and increased adoption of innovations. Among individual schools the ten largest had more than three times as many major innovations listed as the ten smallest. In the Illinois study superintendents identified the major innovations their districts had adopted and continued to use for at least two years. From a variety of analyses it is apparent that increasing size and complexity are associated with increased innovation. Table 5 shows that districts

with high rates of innovation are larger and structurally more complex than those with low rates. There are nearly twice as many students, 50 percent more organizational components, twice as many full-time administrators, and about 25 percent more conflict-preventing policy systems. Table 6, the basic correlation matrix showing the relationship among all variables, substantiates the same conclusion: the rate of innovation is correlated with size at .46, the number of administrative components at .45, job specialization at .48, and conflict-prevention devices at .24.

Interpretation

The data strongly support the argument that size and complexity are associated with the increased adoption of educational innovation. It also seems reasonable to suggest that organizations adopting innovations will sustain those innovations to the extent that a complex organizational system is built to support them. This point has important policy implications, for though no hard data have been collected on the subject, the analysis of hundreds of schools and districts made in the two studies suggests that schools and school districts, as an organizational subtype, are underorganized. In comparison with most complex organizations, schools and school districts have less role differentiation, fewer problem-solving experts, and a smaller number of support services.

How could these ideas be translated into administrative changes? First, the data suggest that more role specialization, the creation of specialized positions and administrative roles, would generate and support innovations. The more organizations develop hierarchical differentiation, the more they will be able to handle innovation. In schools, for example, systems that station middle-level managers between teachers and district administrators can give more support to teachers to fill specialized roles. Examples of middle-level managers would include a variety of curriculum experts, skilled technology directors (to aid in the use of audiovisual equipment, instructional computers, and the like), and "change agents," hired to foster and disseminate innovation.

TABLE 5

Organizational and Environmental Factors
in School Districts with High and Low Rates of Innovation

Factor	Indicators	Definition	Source	High-Innovation Districts[a]	Low-Innovation Districts
Size and complexity	No. of students	District average daily attendance for 1968-69	State Education Dept.	5,335	2,561
	Organizational components	The number of programs and positions that were formally organized in each district	Superintendent's Questionnaire	12.26	8.20
	Specialization	The number of full-time equivalent administrators assigned to the programs reported for "organizational components"	"	25.10	13.89
	Conflict-prevention devices	The sum total of district's use of (a) policy defining the jurisdiction and responsibilities for each major dept., (b) rules governing interdepartmental arrangements, (c) job descriptions for administrative positions, or (d) an organizational chart	"	2.88	2.10
Environmental heterogeneity	Population density	Density of population per square mile within each county (more density = more heterogeneity)	Census Bureau	2,134	1,135
	Percentage of urbanization	The percentage of the county population classified as urban by the Census Bureau (more urban = more heterogeneity)	"	73.95	58.24
	Percentage of nonwhite population	The percentage of nonwhites in each county (more nonwhites = more heterogeneity)	"	7.79	4.76
	Local taxing agencies	The number of public taxing agencies within the county in competition with school districts for tax dollars (more agencies = more heterogeneity)	City & County Data Book	209.40	136.44

TABLE 5 (continued)

Factor	Indicators	Definition	Source	High-Innovation Districts	Low-Innovation Districts
Environmental heterogeneity (continued)	Percentage government expenses to noneducation uses	The ratio of total educational expenditures to total direct general expenditures for local government. A county in which education is the largest public endeavor would have a high educational expenditure ratio, but few other activities (lower ratio = more heterogeneity)	City & County Data Book	51.6	47.2
	Percentage not owning home	The percentage of nonowner-occupied housing in a county was assumed to be a measure of transiency in the environment (less ownership = more heterogeneity)	Census Bureau	38.7	34.7
Environmental change	Change in funds	Percentage change in operating expenses, 1964-60 (AV)	State Education Dept.	69.39	44.90
	Growth of county	Percentage change in district daily attendance, 1964-69	"	17.52	16.54
	Migration	Percentage of population in/out migration, 1964-69	Census Bureau	5.59	-1.18
	Change in wealth	Percentage change in the assessed valuation of the district, 1964-69 (AV/ADA)	State Education Dept.	1.86	1.72
	Change in racial composition	Percentage changes in percentage of nonwhites in each district, 1964-69	Census Bureau	3.28	3.10
	Wealth	Assessed valuation of district	State Education Dept.	$32,470	$31,905

[a]High-innovation districts are defined as those that adopted 34% or more of the innovations possible for them, as determined from the Superintendent's Questionnaire. Low-innovation districts are those that adopted less than 34%.

Source: Data reanalyzed from Burnham (1972).

TABLE 6

Basic Correlation Matrix (Illinois Study)

	COMPLEXITY				ENVIRONMENTAL HETEROGENEITY							ENVIRONMENTAL CHANGE						
	Size	Complexity	Specialization	Conflict prevention	Population density	% urbanization	% nonwhite population	No. local govt. agencies	% govt. expenses to education	% home ownership	Change in funds (AV)	Growth of county	In/out migration	Change in wealth (AV-ADA)	Change in racial composition	District wealth	% innovations adopted
COMPLEXITY																	
Size	1.0	.68	.91	.14	.12	.35	.12	.14	-.15	-.13	.16	.12	-.04	-.16	.17	-.13	.46
Complexity		1.00	.80	.18	.09	.27	.12	.12	-.13	-.13	.08	.07	-.06	-.08	.11	.05	.45
Specialization			1.00	.19	.09	.30	.10	.11	-.11	-.09	.13	.08	-.03	-.13	.20	-.12	.48
Conflict prevention				1.00	.16	.20	.14	.17	-.15	-.12	-.02	.10	.10	-.05	.14	.02	.24
ENVIRONMENT HETEROGENEITY																	
Population density					1.00	.76	.89	.99	-.88	-.88	.20	.17	-.34	-.06	.22	.18	.30
% urbanization						1.00	.67	.80	-.72	-.59	.24	.29	-.09	-.10	.30	.12	.37
% nonwhite population							1.00	.88	-.79	-.84	.15	.13	-.38	-.02	.23	.13	.25
No. local govt. agencies								1.00	-.86	-.86	.20	.21	-.29	-.07	.24	.20	.31
% govt. expenses to education									1.00	.80	-.16	-.09	.44	.04	-.18	-.11	-.26
% home ownership										1.00	-.07	-.07	.64	.06	-.19	-.18	-.27
ENVIRONMENTAL CHANGE																	
Change in funds (AV)											1.00	.64	.12	.27	-.09	-.10	.04
Growth of county												1.00	.25	.30	.07	-.06	.00
In/out migration													1.00	.05	-.05	-.11	-.01
Change in wealth (AV-ADA)														1.00	.00	-.03	-.09
Change in racial composition															1.00	.05	.17
District wealth																1.00	.06
% innovations adopted																	1.00

Source: Data reanalyzed from Burnham (1972).

Second, innovations are likely to be spread widely in an organization with centralized coordination responsible for developing and supporting innovation. Many people have argued that decentralization may act as a catalyst in generating innovations to solve localized problems. (For references, see Sapolsky, 1967.) It may also be true, however, that once initiated, innovations are most effectively spread and sustained by a centralized and administratively complex management. Notwithstanding the widespread belief that decentralization and simple organization promote innovation in schools, more organization and more administrative support are needed if innovation is the goal.

Finally, innovations can demonstrate their effectiveness and win long-term support only if they are systematically evaluated. At the present time little serious evaluation is occurring in most social organizations where new programs have been introduced. In order to obtain less haphazard evaluations, evaluation units should be an integral part of any social action program, constantly monitoring the progress of changes and feeding back results to an ongoing decision-making process. One way to design creative complexity in organizations is to build evaluation units into the middle-level management structure.

In summary, an enriched organizational structure can produce a number of beneficial results. First, innovations of greater difficulty can be undertaken, since individuals directly involved with the innovation will have backup support, staff help, and specialized resources at their disposal. Second, increased middle-level management and the centralization of social action programs can help spread innovations widely by breaking down the barriers that often insulate individuals from each other. Finally, increased complexity can provide the members of an organization with a career ladder that encourages the innovative behavior appropriate to different levels within the system. A major hindrance to innovation, for example, is the essentially "flat" teaching career line, which usually reserves advancement for administrators and offers little incentive to innovative behavior.

Environmental Factors

Although structural complexity and size are important elements in promoting change, environmental factors may also have a great influence. Organization theorists have given increasing attention to the environment in which an organization functions. Organizations obtain inputs of various kinds from their environments, process those inputs, and feed back finished products to the external world. At the same time their surroundings place many demands on them. School districts in particular have highly permeable boundaries and are susceptible to the influence of their various clients (see Bidwell, 1965, and Sieber, 1968). The educational tradition of community interest and influence continues, and it has been joined by the "community control" movement of social programs such as community mental health and economic opportunity projects.

Environmental variability stimulates an organization in many ways. In a rapidly changing environment expectations increase faster than the services offered, and demands for services outrun the ability to pay for them. A more heterogeneous environment with a varied clientele demands diverse services, and results in greater competition for scarce resources from the more fragmented socioeconomic and demographic forces. Increased diversity and uncertainty call for remedial action from an organization, encouraging innovative responses. Corwin suggests that an organization is more open to change when "it is located in a changing, modern, urbanized setting where it is in close cooperation with a coalition of other cosmopolitan organizations that can supplement its skills and resources" (Corwin, 1972, p. 442). The character of the client population served determines the demand for services, the scope of activities, and the human resources to be utilized by an organization. Similarly, since many inputs in the exchange relationship may be resolved financially, the community's wealth is a major environmental variable.

Both the Illinois and Bay Area studies used demographic data as indicators of a school environment's variability. In particular, it was assumed that heterogeneous, changing environments would pose unique

problems for school districts, causing them to make many innovations. Therefore, census-type data were collected to indicate environmental variability and heterogeneity: population density, urbanization, the percentage of nonwhite population in the district, the amount of home ownership, and the number of other government agencies competing for resources.

Empirical Results

The primary environmental data came from the Illinois study, in which the variables were categorized as relating to either environmental heterogeneity or environmental change. The results were different for the two types of variables.

First, analyses of the data suggest that environmental heterogeneity does have a strong impact on organizational innovation. Table 5 shows that all six indicators of environmental heterogeneity have the predicted relationship to innovation. Four of the six are fairly strong: the highly innovative districts were found to have much higher population density, about 50 percent more urbanization, about a 75 percent higher proportion of nonwhite residents, and about 55 percent more government agencies in their environment. The correlations for expenditure rates on education and for home ownership are not as strong, but they are in the predicted direction. The correlation matrix in Table 6 offers additional support for the hypothesis. The relationships between indicators of environmental heterogeneity and innovation range from a low of .25 (between percentage of nonwhite population and innovation) to a high of .37 (between urbanization and innovation).

The second cluster of environmental variables dealt with environmental change: changes in wealth and operating expenses, population growth of the county, migration in and out, and changes in the district's racial composition. The hypothesis was that changes in these factors would create new demands on the districts that would cause them to innovate more.

The results, however, do not support the seemingly plausible hypothesis. Table 5 shows that the highly innovative districts differ only slightly from the less innovative districts in these respects. Although all the differences are in the predicted direction, only two--changes in funds and migration--seem to be of sufficient magnitude to be interesting. In Table 6 the correlations between these change indicators and innovation are extremely low. In short, the various data analyses indicate that environmental change--at least as measured with these indicators--does not encourage innovation in school districts to any significant degree.

Policy Implications: Enhancing Environmental Relations to Promote Innovation

If the multiple demands made by environmental heterogeneity on organizations stimulate innovative behavior, organizations that wish to be innovative, to maintain long-range adaptive behavior, and to be responsive to their external constituencies must establish viable links with their environment. Constructing and maintaining these bridges is difficult, but the following suggestions seem reasonable.

Organizations must continually strive to develop linking mechanisms with their environment. Many school districts, poverty programs, and a few city governments have begun to invite community involvement through policy councils and advisory committees. Although this strategy can stimulate innovative practices, the limited forms of community input must be enriched with additional imaginative approaches.

A second linking mechanism to the environment should be a continuing program of needs assessment. Few social organizations have systematically analyzed demographic data to chart and anticipate changes in their communities' social structure. Unemployment statistics, wage rates, and the economic and job structure of the community are often ignored in social planning. Through cooperative efforts, social agencies could set up regional data centers to process and share demographic information.

Another strategy for opening an organization to outside influences would be to establish technical advisory boards. Some social organizations have turned to community groups for this purpose, but it is rare to find them seeking long-range technical advice from a panel of outside experts. Rather than try out innovative procedures without adequate technical knowledge, school districts might benefit from an ongoing program of technical advice, which would raise their level of expertise and their exposure to innovation. Such advisory boards have been effectively used in government agencies and in research and development centers, and a skillfully constructed program could give systematic technical help to organizations without becoming a one-shot consulting job for outsiders.

Another type of environmental relationship that can further innovation is cooperation between social action programs--that is, strong interorganizational relations. Innovations are more difficult to promote in structurally simple organizations because they often lack resources and specialized manpower. By sharing resources on a regional basis, for example, small school systems with inadequate facilities could build innovative programs beyond their individual capacities. So far, school districts and other social systems have made little progress in achieving this kind of cooperation. Part of the difficulty may be political fragmentation and local jealousies, but sharing resources has merit as a strategy to advance innovative behavior.

Just as important, organizations can be stimulated by reaching out to other kinds of organizations for help and technical knowledge. For example, facilities readily available to many school districts are the faculty, libraries, computer facilities, and laboratories of local colleges or universities. Other virtually untapped resources are local industries and government agencies that could be strong adjuncts to any social action program.

An environmental outreach program should also include special intermediary positions between an organization and its community--the development of strong boundary roles. The top administrators of any organization always fill a boundary role, but other links are needed to expand

openings to the environment. For example, if advisory councils and technical advisory boards were established, coordinators would be needed to act in a liaison capacity. If the assessment of needs became an ongoing process within an organization, people with technical skills and relationships to outside organizations would be needed to gather and process information. If interorganizational relations were to be established with colleges, school districts, or industries, qualified personnel would be essential to fill boundary roles. In short, if a social system is to interact effectively with its environment, structural complexity and role differentiation must be built in. These boundary roles would function both as influential avenues of communication for disseminating innovative procedures and as channels for feedback from the environment.

Summary and Conclusions

This paper has argued that traditional research on innovation and organizational change has too often focused on the wrong clusters of variables. In particular, its orientation toward the early phases of the innovation cycle, its concentration on small-scale technical innovations, and its individualistic biases have hindered our understanding of major organizational innovation. In contrast, a more productive analysis of the change process should concentrate on complex technologies with unclear evaluations, shift the focus from individualistic variables to roles and organizational structure, and examine environmental factors closely.

The second half of the paper has presented an overview of the results from two research projects on organizational change. Those results support the premise that a large, complex organization with a heterogeneous environment is likely to be more innovative than a small, simple organization with a homogeneous environment. The basic logic is that of a "demand structure": (1) Size makes a series of demands about coordination, control, and complexity to which an organization must respond. (2) Differentiation and structural complexity produce

specialists searching for new solutions to the task demands within their specialized realms. (3) A heterogeneous and changing environment surrounding an organization makes numerous demands for responsive behavior.

These structural characteristics of organizations are powerful factors influencing innovative behavior. Certainly, they cannot replace other factors, such as the personality characteristics of administrators or the unique character of the innovations themselves, but when coupled with them, the structural variables play an important role.

These findings have a number of serious policy implications for people who wish to bring about change in educational or other types of organizations. First, they show that size affects innovation and that masses of organizational participants generate a "demand structure" to facilitate innovation. School administrators throughout the country have been arguing for years that consolidating small districts would increase efficiency and bring other economic benefits; in addition, the results discussed here suggest that consolidation would promote innovative practices.

Second, the findings suggest that differentiation and structural complexity foster innovation. For example, relatively undifferentiated smaller school systems do not have enough problem-solving capacity or enough specialized experts to promote innovative behavior. Deliberate attempts at differentiation can be made, such as employing "change agents" to disseminate emerging innovations and technologies. Other strategies for fostering organizational innovation are to establish cooperative agencies to gather and process information and to set up interorganizational committees on innovation.

The conclusion that structural factors can promote innovation also suggests that we must study more carefully the issue of structural factors that will sustain innovation. Unless innovations are structurally, financially, and politically supported within the organization, they are likely to fail--as those who have tried to change organizations will sadly testify. In short, research is needed to answer such questions as these about the actual implementation phases: (1) What kinds of reward structures are necessary to support the innovation? (2) What kinds of political

coalitions are needed to give the innovation viability? (3) What kinds of authority structures will support the innovation rather than undermine it? (4) How should the new program be financed? (5) How can the innovation's effectiveness be evaluated?

Finally, the data indicate that environmental variability is a strong factor in promoting innovation. For example, in the past serious innovation in education has occurred when advocates of community control gained enough power to inject significant input into their district. In effect, any social organization seeking innovation must make itself vulnerable by opening channels of communication and influence to its environment.

The final shift in perspective concerns the overall orientation to the problem of innovation and change in organizations. The commonly used terminology alone points in the wrong direction; to speak of the "adoption" of innovations induces thoughts of a commercial distribution of products from a manufacturer to a potential buyer. With that perspective the research and development community may be tempted to become hucksters of particular products, and, in their urgency to sell, they may overlook the need to build problem-solving capacity in the organizations they are serving. Researchers, developers, administrators, and educators have seldom created an innovative environment in which alternatives could be considered and options explored.

In an insightful comment Donald Campbell suggests that the tradition of social innovation that ties itself to particular products and techniques has led to social waste and has necessitated the defense of innovations that did not deserve defending. Campbell argues instead for a risk-taking approach to solving social problems, exploring a variety of innovations and techniques:

> If the political and administrative system has committed itself in advance to the correctness and efficacy of its reforms, it cannot tolerate learning of failure. To be truly scientific we must be able to experiment. We must be able to advocate without that excess of commitment that blinds us to reality testing. . . .

> One simple shift in political posture which would reduce the problem is the shift from the advocacy of a specific reform to the advocacy of the seriousness of the problem, and hence to the advocacy of persistence in alternative reform efforts should the first one fail. The political stance would become: "This is a serious problem. We propose to initiate Policy A on an experimental basis. If after five years there has been no significant improvement, we will shift to Policy B." By making explicit that a given problem solution was only one of several that the administrator or party could in good conscience advocate, and by having ready a plausible alternative, the administrator could afford honest evaluation of outcomes. Negative results, a failure of the first program, would not jeopardize his job, for his job would be to keep after the problem until something was found that worked.
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> [Campbell, in Weiss, 1972, p. 189.]

We must not be in the business of disseminating a particular exciting new product; we must be in the business of creating organizations with built-in capacities for assessing their needs and creating viable alternatives. The adoption of any specific innovation is a sideline activity that must not consume our energies. Our continuing enterprise should be the building of flexible organizations responsive to their environments, organizations with reserves of expertise and resources to sustain long-range problem solving.

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